ZOOLOGY.—*Some Rhizocephala found on brachyuran crabs in the West Indian region.* Edward G. Reinhard, Catholic University of America.

The present paper contains notes on six species of the genus *Sacculina* which occur in the Gulf of Mexico and the Caribbean Sea. Two of these are described as new and are named *Sacculina americana* and *Sacculina boschmai*. The specimens reported on are chiefly recent accessions of the United States National Museum which were lent to the writer for study. The drawings (except Fig.1) were made by Miss Pei-Tsing Liu.

In addition to the species treated here, there are two other members of the genus reported for the West Indian region. These are *Sacculina hirsuta* Boschma, which occurs on *Pilumnus caribaeus* and *Pilumnus dasypodus* (Boschma 1925, 1931; Reinhard 1950), and *Sacculina schmitti* Boschma 1933, 1950) known only from the type specimen found on *Anomalothir furcillatus*.

Sacculina bicuspidata Boschma

Fig. 1

Sacculina bicuspidata Boschma, 1931, pp. 342–344, fig. 7, 1 (external appearance), fig. 31 (longitudinal sections), fig. 32 (external cuticle); 1937, pp. 212–213, fig. 8 (male organs and colleteric glands).

Type specimen on *Microphrys bicornutus* (Latreille). Tobago, British West Indies.

Material examined.—Eastern shore, St. Thomas, Virgin Islands, St. Thomas Harbor, station 23, April 4, 1937; two specimens on two *Microphrys bicornutus* (Latreille). Smithsonian-Hartford Expedition. U.S.N.M. 92179.

Gulf of Mexico, *Oregon* station 279, 29° 11′ N., 86° 52.5′ W., 305 fathoms; February 24, 1950; one specimen on *Trachycarcinus spinulifer* Rathbun. U. S. Fish and Wildlife Service coll. U.S.N.M. 92355.

The larger of the two specimens from St. Thomas measures 5 mm in length, 5.5 mm in breadth, and 2 mm in thickness; the smaller one, 3 by 3 by 1.5 mm. In both cases the mantle opening is elevated but not conspicuously so. The posterior angles of the larger specimen are drawn out into lappets. The external cuticle bears delicate rugae resembling a fingerprint pattern. Both specimens have eggs in the mantle cavity and are therefore mature.

Sections were made of the smaller specimen. The thick-walled, cylindrical testes, located outside the visceral mass, are separate tubes of approximately equal size that merge gradually into short vasa deferentia. The vasa twist slightly near their terminations. A muscular sheath surrounds each testis. The colleteric glands are one or two rows in thickness with about 20 tubes visible in the most divided portion. The innermost tubes, where the gland is thickest, form large sinuslike spaces.

The specimen from *Oregon* station 279 measures 5.5 mm in length, 6 mm in breadth, and 2 mm in thickness, dimensions which correspond almost exactly with those given for the type specimen. It is also similar to the type in having a straight posterior border and the mantle opening at the summit of a rather prominent tube.

The testes occur in the stalk region in a muscular portion outside the visceral mass. They

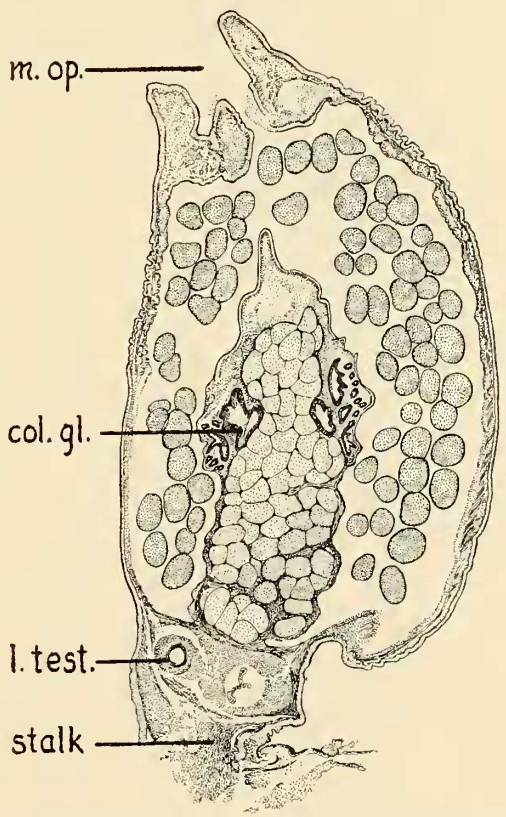

Fig. 1.—*Sacculina bicuspidata* Boschma. Longitudinal section of parasite found on *Microphrys bicornutus* (Latreille). m. op., mantle opening; col. gl., colleteric gland; l. test., left testis.

are approximately of the same size and comparatively large and thick-walled. At first they are solid; a lumen appears only in the proximal half from which the vasa deferentia originate. They run a straight course close together, then later they touch but never become fused.

The vasa deferentia appear gradually, run straight at first in a ventral direction, then diverge to the right and left and become slightly twisted as they terminate on either side of the posterior tip of the visceral mass.

The colleteric glands, located in the anterior half of the visceral mass, consist, in the main, of one row of tubes with a few large sinuses toward the interior. The maximum number of tubes seen in any one section is 20 to 22.

The eggs in the visceral mass are extremely small and no embryos are present in the mantle cavity. This, in conjunction with the fact that the testes are in part solid, indicates an immature animal.

Sacculina americana, n. sp.

Fig. 2

Cotypes.—Gulf of Mexico, *Oregon* station 319, 29° 20′ N., 87° 25′ W., April 28, 1951; four specimens on one *Trachycarcinus spinulifer* Rathbun. U. S. Fish and Wildlife Service coll. U. S. N. M. 96988.

Diagnosis.—Sac broadest in anterior half, tapering to stalk posteriorly. Male genital organs outside the visceral mass. Testes globular, thin-walled, completely separated, one larger than the other. Vasa deferentia narrow, emerging abruptly from the testes. Colleteric glands shallow with a comparatively small number of tubes. External cuticle etched with short irregular branching grooves. Internal cuticle with retinacula consisting of one or two spindles, particularly abundant in the vicinity of the mantle opening.

Description.—This species of *Sacculina* has a rather unusual shape. All four specimens are

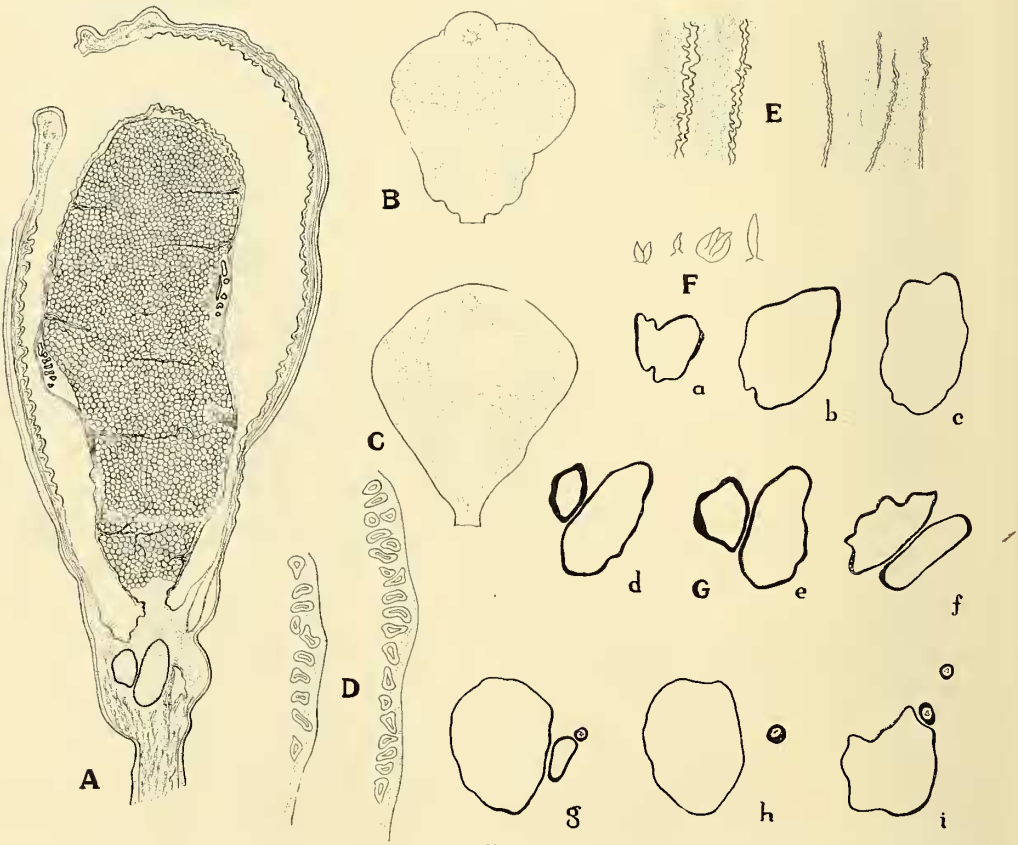

Fig. 2.—*Sacculina americana*, n. sp.: A, Longitudinal section; B, External appearance of the smallest specimen, × 3. C, External appearance of the largest specimen × 2. D, Longitudinal sections of the colleteric glands. E, Surface of the external cuticle. F, Retinacula. G, Series of transverse sections of the male genital organs starting from the distal end of the right testis (a) and ending with the proximal end of the left testis (*i*) and the vasa deferentia (*g*, *h*, *i*).

broadest in the anterior half and taper gradually to the stalk. The prominent mantle opening, surrounded by a thick pad, is in the center of the anterior surface but turned to the left side. The smallest specimen measures 10 mm in length, 9 mm in breadth and 4 mm in thickness; the largest 15 by 13 by 5 mm.

One parasite was treated with KOH for a study of the cuticulas and the largest member of the group was selected for sectioning. The external cuticle has a thickness of 24 to 32μ. Its surface is engraved with minute sinuous grooves that have short side branches. This pattern is broken by more widely spaced deeper grooves. In cross section the external cuticle has a ragged appearance and its surface takes a darker stain than the interior. The internal cuticle has sparse retinacula except in the vicinity of the mantle opening where they are extremely abundant and crowded together in islandlike groups. Each retinaculum consists of an elevation bearing one or two pointed spindles. The spindle measure 20 to 30μ in length.

The globular testes, located near the base of the stalk outside the visceral mass are thin-walled and lie directly alongside each other. The right testis is noticeably larger and longer than the left, but spermatozoa are present in both. The slender vasa deferentia emerge from the upper end of the testes as straight tubes that quickly diverge in an antero-ventral direction and become slightly twisted as they terminate.

The colleteric glands are shallow, with 20 to 23 tubes in the region of maximum division. They contain a chitin lining.

Sacculina reniformis Boschma

Fig, 5, A, B, C

Sacculina reniformis Boschma, 1933, p. 227, fig. 9 (external cuticle); 1937, pp. 300–301, fig. 75 (male organs and colleteric glands); 1950, p. 19, fig. 1, i (external appearance), fig. 6, b (longitudinal section).

Type specimen on *Podochela riisei* Stimpson, off Cape Sable, Fla.

Material examined.—Gulf of Mexico, *Oregon* station 36; 28° 30′ N., 85° 36′ W., 120 fathoms; June 27, 1950; two specimens on two *Collodes leptocheles* Rathbun. U. S. Fish and Wildlife Service coll. U. S. N. M. 91107.

The larger specimen measures 4.5 mm in length, 7 mm in width and about 4 mm in thickness; the smaller one, 4 by 6 by 3.5 mm. Both are slightly larger than the type specimen. The mantle opening, described in the type as lying "at the extremity of a very short, rather wide tube," is relatively small and inconspicuous in these examples, but protrudes a little above the surface. The presence of Liriopsid parasites in the mantle cavity of both specimens has apparently caused some distortion in the shape of the sacs. Their contour, although reniform, is somewhat angular.

The external cuticle of both specimens is covered with small dentate excrescences about 6 to 8μ in height. Except for the presence of a few short hairs on the tip and sides of these processes, they are exactly like those illustrated for the type specimen (Boschma, 1933, fig. 9).

The numerous retinacula found on the internal cuticle are single spindles, extremely variable in size and shape and ranging from 14 to 35μ in length. No retinacula were seen in the type specimen, but failure to find them is not always proof that they do not exist.

The testes lie outside the visceral mass in the posterior region of the body. They begin on the dorsal side of the animal not far from the edge of the stalk. At first they are completely fused so that there is only one lumen. Then two lumena appear, but the intervening walls remain united. Shortly after, without diverging, they gradually pass into the vasa deferentia that become smaller as they approach their terminations. The vasa deferentia are relatively short tubes, slightly coiled just before they terminate.

The colleteric glands occur in the anterior half of the visceral mass and contain only a few tubes. About 10 tubes appear in the most divided portion of the gland. The glands project slightly from the surface of the visceral mass.

Sacculina boschmai, n. sp.

Figs. 3, 4

Type.—Gulf of Mexico, west coast of Florida, *Albatross* station 2401, 28° 38′ 30″ N., 85° 53′ 30″ W., 142 fathoms, March 14, 1885; one specimen on *Acanthocarpus alexandri* Stimpson. *Albatross* coll. U. S. N. M. 96989.

Diagnosis.—Sac broadly oval, with greatest diameter along dorso-ventral axis; mantle opening and stalk prominent. Male genital organs outside visceral mass; testes cylindrical, separate; right testis enlarged, left rudimentary. Vasa deferentia slightly coiled at terminations. Colleteric glands in anterior half of visceral mass with a moderate number of tubes. External cuticle of mantle with short papillae approximately 12μ

long, covered with minute hairs and staining more darkly than the rest of the cuticle. Retinacula consisting of a basal part and one or two smooth spindles about 15μ long.

Description.—The parasite measures 9 mm in length, 12 mm in width and 5 mm in thickness. The sac, one-third broader than long, is convex at the anterior and posterior margins and strongly arched at the dorsal and ventral margins. The thick stalk arises from a depression on the left side of the animal near the posterior end. The mantle opening, also shifted slightly to the left, is at the center of the anterior surface opposite the stalk. It is encircled by a heavy ridge with prominent folds.

In surface view the external cuticle has a rough "shark-skin" appearance due to innumerable excrescences set close together. These are short, pointed papillae or denticles, covered with minute hairs. The excrescences have a length of 10 to 15μ and in sections it may be seen that they take a darker hematoxylin stain than the subsurface cuticle. For the most part, the external cuticle is 50 to 70μ in thickness.

Retinacula, consisting of a basal hump and one or two smooth spindles, are present on the internal cuticle. They have a length of 14 to 17μ.

The testes occur in the thick mesentery of the stalk region completely outside the visceral mass. The right testis is greatly enlarged while the left testis is rudimentary and attached to the wall of the right testis. Each testis is surrounded by a muscular sheath. A peculiar feature of the histology of the right testis is the unusually large number of nutritive or supporting cells present. These are very large clear cells, one to three rows deep, around which the spermatocytes and spermatids are clustered.

The functional testis has the shape of a wide cylindrical sac, tapering at both ends. The wall appears to be of rather delicate construction and presumably, because it lacks any firm tissue, yields to contractions in such a way that in cross-section this testis has an irregular rather than a smoothly rounded outline.

The vasa deferentia emerge gradually from the ventral extremities of both testes. They are rather narrow tubes, straight for most of their course, becoming coiled only at their terminations.

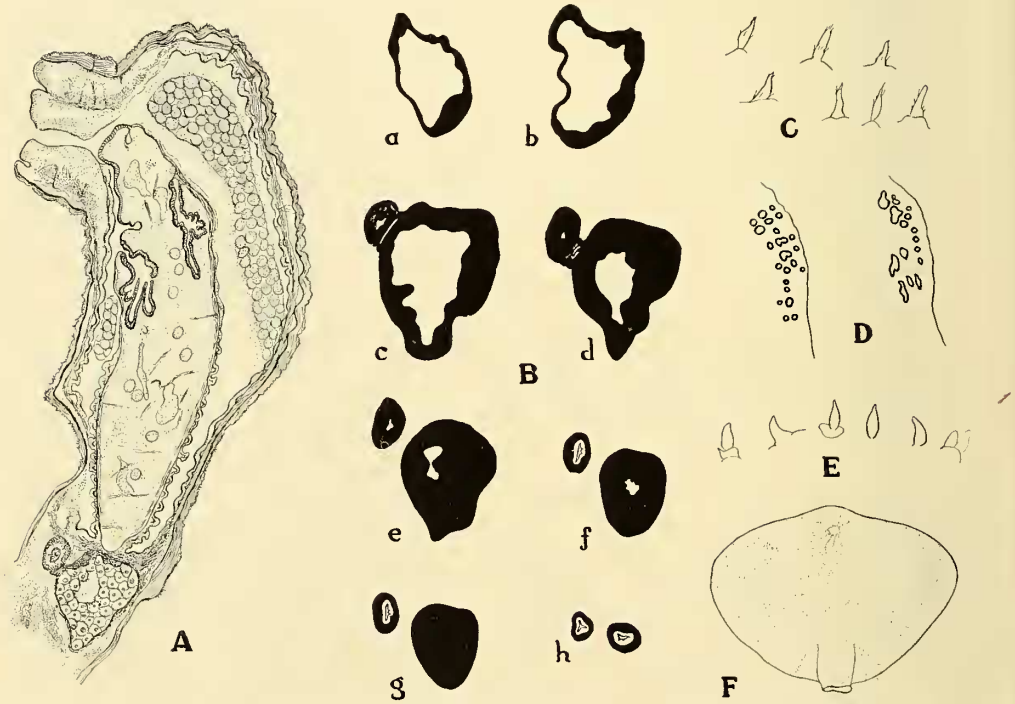

FIG. 3.—*Sacculina boschmai*, n. sp.: A, Longitudinal section. B, Series of transverse sections of the male genital organs starting from the distal end of the right testis (a) and ending with the vasa deferentia (h). The rudimentary left testis appears in c, d and e. C, Excrescences of the external cuticle. D, Longitudinal sections of the colleteric glands. E, Retinacula. F, External appearance seen from the left side.

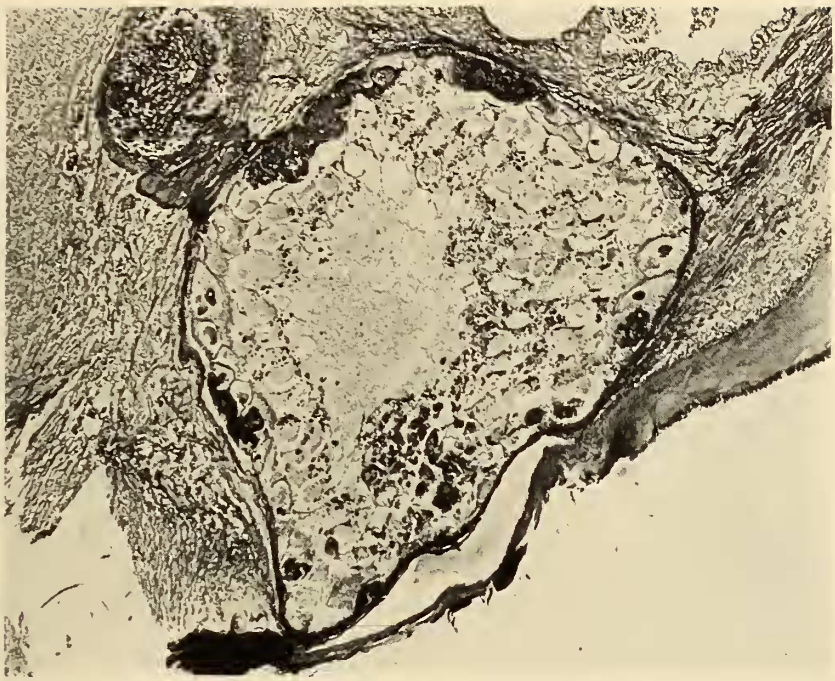

Fig. 4.—*Sacculina boschmai*, n. sp. Photomicrograph showing the histological structure of the testes

The colleteric glands occur in the anterior half of the visceral mass. Each gland consists of three rows of tubes. These are not gathered into compartments. The maximum number of tubes seen in a cross-section of one gland is 24.

The ovary of this specimen appears to be exhausted, but there are numberous eggs in the mantle cavity, particularly on the right side of the visceral mass, where the cavity is considerably more voluminous.

At the exit from the mantle cavity the body wall increases more than three times in thickness where it forms thick folds around the mantle opening. A prominent sphincter muscle is present here and a series of blood lacunae occur in the space between the sphincter and the external cuticle.

Remarks.—This is the specimen recorded by Rathbun (1937, p. 227) in her monograph on oxystomatous crabs, where it is referred to as "Peltogaster."

Sacculina pustulata Boschma

Fig. 5, D

Sacculina pustulata Boschma, 1925, pp. 11–12, text figs. 2 and 3 (external cuticle), pl. 2, fig. 2 (external appearance), fig. 6 (longitudinal section), fig. 7 (vas deferens); 1937, pp. 298–299, fig. 73 (male organs and colleteric gland).

Type specimen on *Hemus cristulipes* A. Milne Edwards.

Type locality: Spanish Water, Curaçao.

Material examined.—10 miles southeast of Alligator Point, Franklin County, Fla., 6 fathoms, November 28, 1952; one specimen on *Hemus cristulipes* A. Milne Edwards. M. L. Wass coll. U. S. N. M. 94050.

This is a very small parasite, although fully mature. It has a length of 2 mm, a breadth of 2 mm, and a thickness of 1 mm. In external appearance it agrees with Boschma's description of the somewhat larger type specimen both with respect to shape and to the fact that the eggs in the mantle cavity are visible through the thin mantle and impress upon it a hexagonal pattern.

The testes are completely separated, unequal in size, and located outside the visceral mass. The short vasa deferentia become quite narrow and contorted near their terminations and have a heavy chitin lining. The colleteric glands have few tubes.

The host, a small crab measuring only 5.5 mm in carapace length and 4.0 mm in carapace width, shows marked effects of sacculinization. It is a modified male with prominent copulatory pleopods but possessing additional pleopods of the female type and a broad abdomen.

Sacculina rathbunae Boschma

Fig. 5, E

Sacculina rathbuni Boschma, 1933, pp. 222–223, fig. 4 (external cuticle); 1937, pp. 299–300, fig. 74 (male organs and colleteric gland).
Sacculina rathbunae Boschma, 1950, pp. 9–10, fig. 1, d (external appearance).

Type specimen on *Arachnopsis filipes* Stimpson, west coast of Florida.

Material examined.—Los Roques Islands, Venezuela, one specimen on one *Stenorynchus seticornis* (Herbst). Sociedad de Sciencas Naturales La Salle coll. U.S.N.M. 195031.

This new host belongs to the same family (Majidae) and subfamily (Inachinae) as the host of the type specimen.

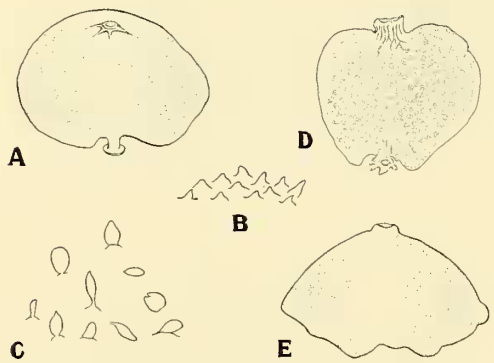

Fig. 5.—A–C, *Sacculina reniformis* Boschma. A, External appearance × 5. B, Excrescences of the external cuticle, surface view. C, Types of retinacula. D, External appearance of *Sacculina pustulata* Boschma × 12. E, External appearance of *Sacculina rathbunae* Boschma × 15.

The parasite is a small one, measuring only 1.5 mm in length, 2.5 mm in breadth and 1 mm in thickness. The dorsal and ventral margins form nipplelike prominences and the term "lozenge-shaped," applied to the type specimen, is also appropriate here.

Sections of this animal revealed that it conforms to the type specimen with respect to the male genital organs. The testes, equal in size, are separate, although in part contiguous and are located in the visceral mass close to the mesentery. They are straight and gradually pass into vasa deferentia, comparatively narrow tubes that also run a straight course.

The colleteric glands are made up of a small number of tubes, 5 to 10 in most sections, arranged in a single row. One gland, however, in the region of maximum division, has 12 tubes forming a double row.

The specimen is a juvenile one, with the mantle cavity appearing as a mere cleft. The sac was still enveloped by the thin chitinous sheath which covers young rhizocephalids previous to the unveiling of the mantle opening. This loose sheath was removed before sectioning the animal and beneath it were found four cypris larvae. They were attached to the inner surface of the sheath near the anterior end. A collection of cypris larvae fixed to a young sacculinid under similar circumstances was observed by Boschma (1931, p. 367) in the case of *Loxothylacus panopei* (Gissler).

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